FEEDLOT DESIGN AND CONSTRUCTION

11. Sediment removal systems

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Introduction

Sedimentation systems are constructed to capture and detain rainfall runoff, allowing any entrained sediment to 'settle out' before the runoff enters the feedlot holding pond or ponds. The system function is to reduce sediment deposition in the holding pond and remove sediment from the system.

Design objectives

Feedlot sediment removal systems should be designed, constructed, operated and maintained to ensure that

- entrained manure and other solids are removed or 'settled' from the runoff before it enters the holding pond, thereby
    - maximising the active storage volume of the holding pond
    - reducing the probability of holding ponds overtopping
    - reducing the required frequency of sludge removal from the holding pond
    - reducing the biological loading on the holding pond and therefore the intensity and duration of holding pond odour emissions.
- sedimentation systems drain freely, with minimal clogging of the 'control outlet'.
- settled solids dry rapidly, thereby reducing the intensity and duration of sediment system odour emissions.
- contamination of underground water resources by the leaching of runoff below the bed of the sedimentation system is avoided by ensuring that the system is constructed on low permeability soils, or alternatively, sealed with a suitable clay or synthetic liner.
- deposited sediments can be removed from the sedimentation system in a practical, cost-effective and efficient manner.
- in wet areas, more than one sedimentation basin should be built so that one can be drying whilst the other is in use.
- The control weir is capable of discharging the peak flow following a 50-year average recurrence interval (ARI) design storm without the system embankment overtopping.

Mandatory requirements

The National Guidelines for Beef Cattle Feedlots in Australia provide the following design standards for sedimentation systems

- Sedimentation systems should be designed to cater for the peak flow rate from a design storm having an ARI of 1 in 20 years, when applying runoff coefficients of 0.8 for feedlot pens, roadways and other hard areas and 0.4 for grassed areas within the controlled drainage area.
- The maximum flow velocity in the sediment system is 0.005 m/s.
- Flow from the sedimentation system should be regulated by a control weir.

- A minimum freeboard of 0.9 m should be provided between the weir crest and the crest of the sedimentation system embankment. The control weir should be capable of discharging the peak flow from a 50-year ARI design storm without the system embankment overtopping.
- Sedimentation basins and terraces should be capable of free draining down to bed level, and have a bed slope of at least 0.1% towards the control outlet weir to facilitate drainage.
- The sedimentation system should be underlain with at least 300 mm clay or other suitable compactable soil, or a synthetic liner able to provide a design permeability of <1 × 10-9 m/s (~0.1 mm/d) and a solid base for maintenance equipment to access the system for sediment removal without damaging the impermeable surface.

Design choices

Sedimentation systems are used for two different wastewater streams in feedlots. The larger sedimentation systems are those that are designed to remove entrained solids in the runoff from the controlled drainage area. As runoff from this catchment is predominantly controlled by rainfall, the inflow to the large sedimentation system is of varying frequency, duration and flow volume, with long periods of no inflow.

The second type of sedimentation system is that used for smaller sub-catchments where a constant wastewater flow occurs, such as cattle handling facilities, cattle washes and truck washes. These basins have a low peak flow rate with a regular inflow.

Three basic types of sedimentation systems are commonly used in feedlots

- sedimentation basins
- sedimentation terraces
- sedimentation ponds

These three types of sedimentation systems are briefly described in the following sections.

Design fundamentals

Outlet control

In all cases, the design principle of the sedimentation system is that solids entrained in the runoff are transported via drains at a high velocity until the runoff enters the sedimentation system where the flow velocity reduces to a very low value. A significant proportion of the entrained and suspended solids settle to the base of the sedimentation system.

Non-settleable solids suspended in the runoff slowly flow into the holding pond via an outlet structure. Rather than acting as a filtering device, the sedimentation system outlet structure is intended to function as a discharge regulator, regulating the outflow and giving the settleable solids the opportunity to settle out in the sedimentation system upstream of the outlet structure.

A large shallow sedimentation basin drying out after storm runoff

One cell of a sedimentation terrace with multiple cells – drying out after runoff

A sedimentation pond (5 m deep) that stays full of liquid. This pond has an inlet weir for incoming sediment and effluent runoff, and an outlet weir to a shallow, large surface area evaporation basin.

Basin configuration

The efficiency of solids removal by the sedimentation system depends greatly on basin configuration. This includes the location of the inlet in relation to the outlet, which influences the flow path across the basin. Ineffective configurations result in poor solids removal. Basin configurations should be selected to suit site characteristics such as topography and the location of inflow points.

Sedimentation basins

These systems are typically wide, shallow storages, having a maximum water ponding depth less than 1 m. They are designed to drain completely (down to bed level) following a runoff event. The bed of the basin should slope towards the control outlet at a gradient of at least 0.1%. Solids are deposited in relatively thin layers over a large area, facilitating rapid drying after the basin has drained of liquid material. The dried solids can then be removed at the earliest possible opportunity.

Sedimentation basins have a large surface area; they are suited only to a site with a large, flat area below the feedlot pens. Sedimentation basins are not suited to steep or confined sites. The surface area of the sedimentation basin becomes part of the catchment area for the holding pond. Machinery must be able to access the base of the basin to gather and remove the dried solids.

Single sedimentation basins are not suitable in areas of high annual rainfall or prolonged winter rainfall. In both situations the basin does not dry out and so wet solids remain in the basin for prolonged periods causing odour. In these areas, there should be at least two basins in parallel so that one basin can be drying before cleaning whilst the other is in use.

Sedimentation terraces

Sedimentation terraces are relatively narrow, shallow basins, having gently sloping bed gradients (approximately 0.1 to 0.5%). Two or three terraces are commonly constructed in series, separated by control weirs similar to those provided in basins. Depending on the terrain, drop structures may be incorporated into the control weirs when there is a significant difference in bed elevation between consecutive terraces.

Similar to sedimentation basins, terraces are designed to drain completely, down to bed level, following a runoff event. Solids are deposited in relatively thin layers promoting rapid drying. Cleaning operations are generally similar to those for sedimentation basins. Sedimentation terraces are suited to steep sites where large, flat areas are not available. By using a series of cells and a drop structure at each cell, a large vertical drop from the pens to the holding pond can be managed.

Sedimentation ponds

Sedimentation ponds are designed to retain some runoff at all times and not intended to drain completely following runoff events. They are generally greater than 1.0 m deep although shallow ponds have sometimes been used. Generally, at least two ponds are required in parallel so that one pond can be isolated for drying before cleaning whilst the other pond is in use. Solids settle to the bottom of the sedimentation pond, which must be desludged at regular intervals. Some sedimentation ponds usually use earth or grassed bywashes rather than control weirs to discharge runoff into the holding ponds.

Sedimentation ponds should be designed to enable desludging using an excavator. This can be achieved by having a high length to width ratio to allow for access by an excavator along the banks of the basin. It should be noted that because sedimentation ponds retain liquid and contain decomposing manure, they are a potential source of odour. The earthworks for the sedimentation ponds are constructed under the design criteria laid out for holding ponds in Section 12.

Typically, sedimentation ponds are used in high rainfall climates with frequent runoff or winter-dominant rainfall zones.

Outlet control

Control outlets should be designed to temporarily retain effluent within the sedimentation system. They regulate the discharge from the sedimentation system into the holding pond and safely discharge flows in excess of the design flow. Well-designed control outlets allow liquid effluent to drain freely from the entire depth of the settled sediment down to the bed of the basin or terrace, enabling easy removal of sediment during cleaning.

The following basic types of control outlets are currently being used successfully at feedlots in Australia

- horizontal timber drop-board weir
- vertical timber weir
- single vertical slot throttle weir

Figure 1 shows a plan view and cross section detail views of a typical design of a horizontal timber drop-board weir structure, including the block wall and board retainers. Detail 1 shows how the boards are chamfered in the direction of flow to allow remaining sediments to move freely through the weir to prevent clogging. The top of the weir boards is lower than the concrete block sidewall to allow high level discharge over the weir following major rainfall (see Figure 5).

In this type of weir, the horizontal drop-boards are wedged apart to enable the liquid effluent to drain from the sediment deposited on the upstream side, and the gaps may be altered by installing different sized wedges. Timber slatted control weirs are effective, low cost and do not rely on human intervention to work efficiently.

Figure 2 shows the vertical timber weir. This type of weir incorporates a series of hardwood timber slats mounted vertically across a reinforced concrete structure constructed in a basin or terrace embankment. The gaps between the slats extend down to the bed of the basin or terrace to allow the entire depth of sediment to drain. Well-designed vertical timber weirs are less likely to require manual manipulation to enable the entire depth of sediment to drain.

Figure 3 shows the single vertical slot throttle weir. The sole purpose of this weir is to slow the runoff so that entrained manure can settle out. All liquid and some solids will pass through the slot.

Horizontal timber slat control weir after a storm, with floating material retained in the sedimentation basin.

Horizontal timber slat control weir showing deposited sediment on the upstream side with little manure on the downstream side. The basin has drained completely and is drying out so that the solids can be removed.

A single row vertical timber weir, with no overtopping freeboard

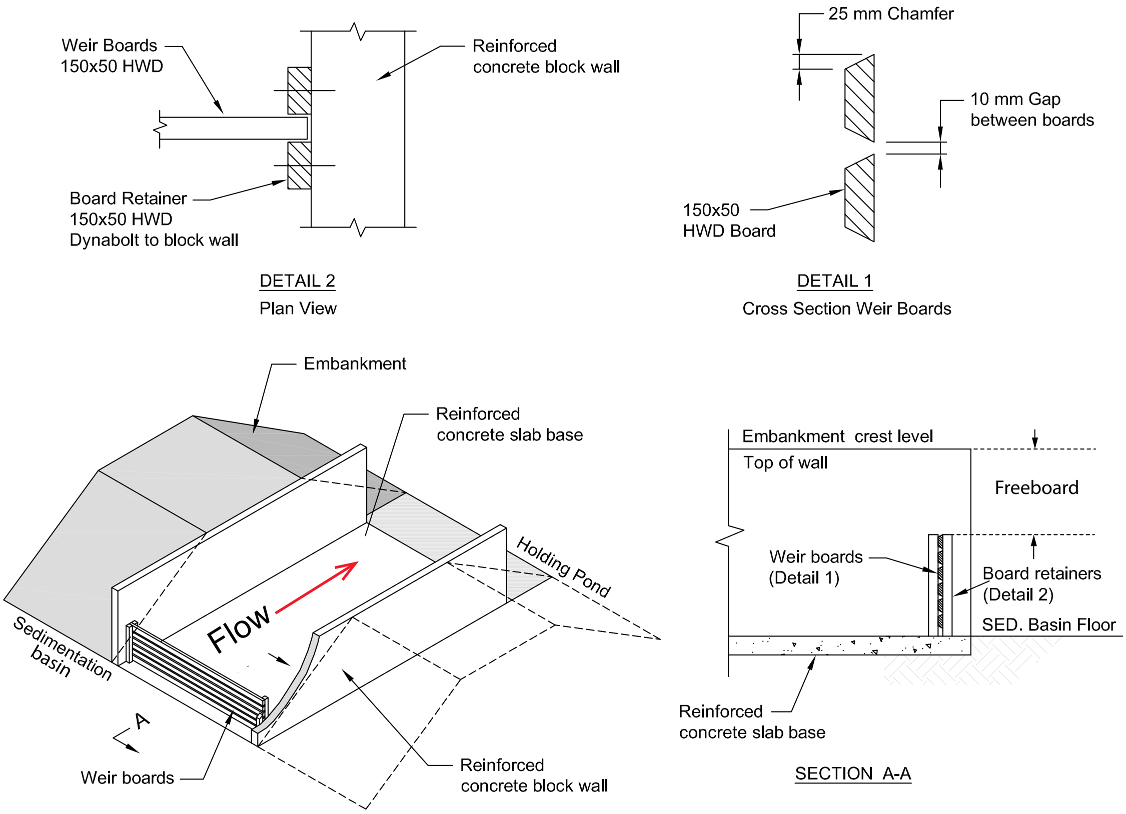


Figure 1. Typical horizontal timber drop-board weir

Typical vertical timber board weir, incorporating two rows of drop-boards and reinforced concrete base.

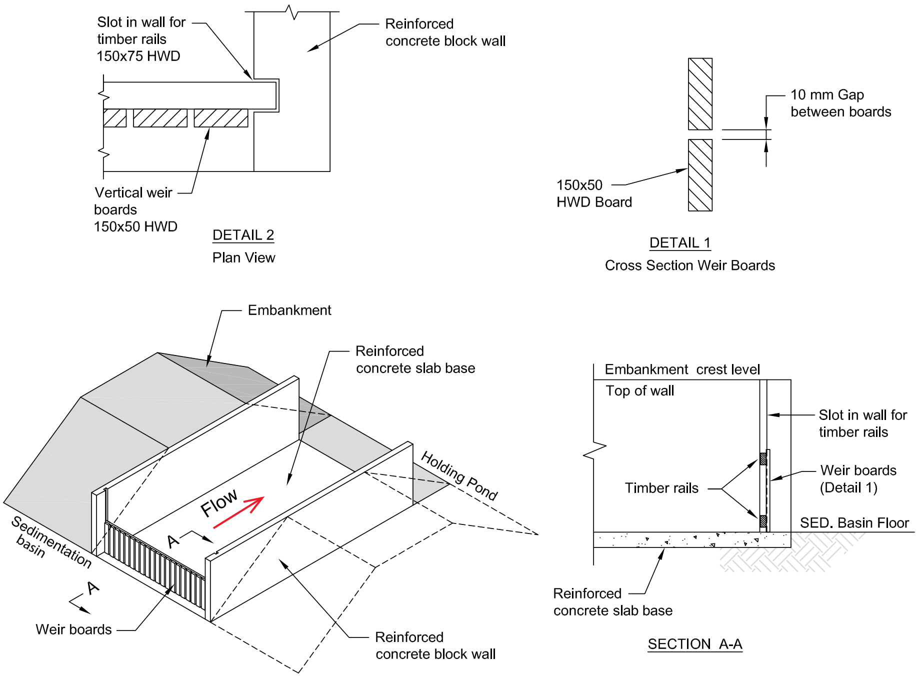


Figure 2. Typical vertical timber weir

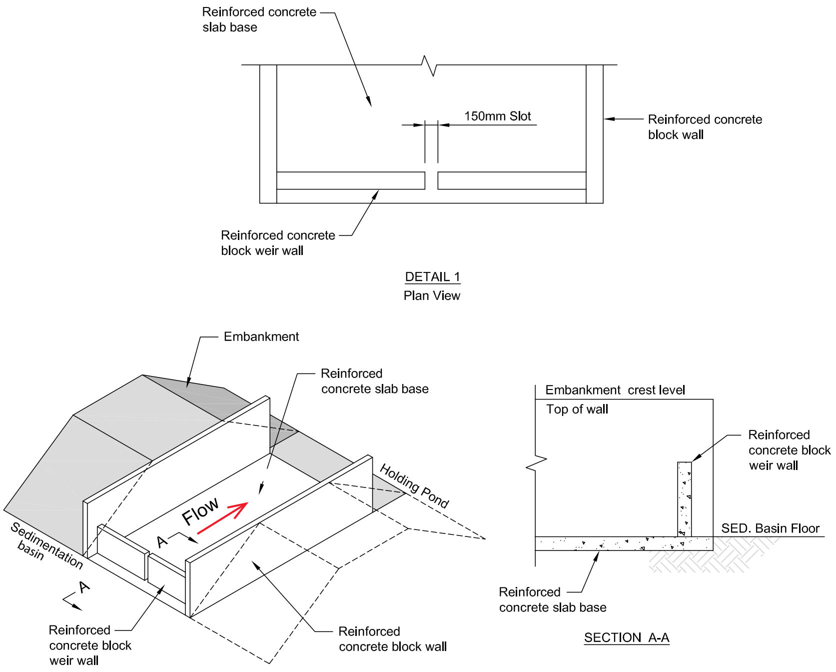


Figure 3. Typical single vertical slot throttle weir

A vertical slot weir used in a sedimentation terrace

A drop weir structure on a sedimentation basin relies on human intervention for use. Thus the operation of the system can be stalled if workers cannot reach the sedimentation system as during flooding.

A typical horizontal timber drop-board weir. There should be a minimum freeboard of 900 mm between the control weir crest and the crest of the sedimentation system embankment.

Sedimentation system configuration

The shape of the sedimentation system and the relative position of the inlet and outlet have a major effect on the performance of solids removal. Even though the length to width ratio is important, aspects such as inlet and outlet location and channelling due to vegetation or bed topography have major impacts. The following design aspects can affect the hydraulic conditions which often characterise the complexity of various sedimentation systems

- bed shape (i.e. flat or angled bottom)
- configuration (i.e. island, internal berms)
- depth
- length to width ratio
- shape (i.e. curved, circular, triangular or rectangular)
- baffles or channels/flumes
- inlet and outlet weir control location and type.

One of the key factors in sedimentation system design is to account for the configuration of the system (location of inlet and outlet structures, shape) and the effects of the different configurations on settling efficiency directly relating to the ability of the system to short circuit. Different configurations can be described by a parameter known as Hydraulic Efficiency (η) (Persson et al. 1999).

Figure 4 shows 13 hypothetical sedimentation system configurations with no vegetation and each having the same surface area.

The hydraulic efficiencies of these systems have been evaluated on a scale ranging from 0 to 1, with 1 representing the best hydrodynamic conditions for sediment removal. A subsurface berm, baffle or island placed in front of the inlet improves hydraulic performance by minimising short-circuiting and increasing the effective volume and degree of mixing. In Figure 4, cases P and O contain an island;

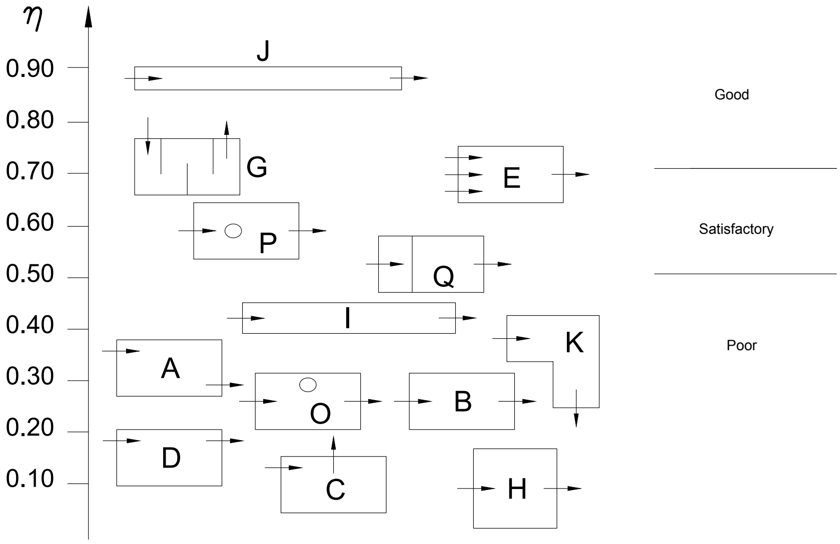


Figure 4. Hydraulic efficiency of different shapes and configurations of sedimentation basins

Rock-filled weirs are a poor design choice as they clog easily.

Case Q has a sub-surface berm; Case G has 3 berms; Case J is effectively a sedimentation terrace. The locations of the inlets and outlets have a considerable impact on the performance of solids removal. Maximising the flow path length between them is critical for achieving high hydraulic retention and good settling characteristics. Sedimentation systems should be designed to have a value of not less than 0.5 and appropriate layouts can be adopted from Figure 4.

Higher values of hydraulic efficiency (λ) indicate sedimentation systems having more effective settling performance. If the basin yields a lower value, modification to the basin configuration should be explored to increase the value (e.g. inclusion of baffles, islands or flow spreaders). As a guide, hydraulic efficiency above 0.7 is considered good, between 0.5 and 0.7 is considered satisfactory and less than 0.5 is considered poor.

Consideration of access to a basin for cleaning/maintenance is crucial when designing the structure as this may impact the shape and configuration.

For example, if a sedimentation system with a configuration similar to configuration H is used in a feedlot, the hydraulic retention could be improved by including internal berms (such as in configuration G). The inclusion of berms should be designed such that an excavator would be able to use them for maintenance and removal of sediment.

Sediment removal system design process

The steps in the design of the sediment removal system are

Step 1

Assess the characteristics of the proposed sediment removal system site, including topography, available spatial area, soil types, location of above and below ground services, potential runoff inflow points and access points for sediment removal equipment.

The choice and configuration of the site for the sediment removal system may be flexible for a greenfield site, but not for an existing site where spatial constraints may limit the available area between the existing feedlot pens and the holding pond. In this case, a sedimentation pond may be a preferred option as a larger volume can be obtained with a smaller footprint. Sediment removal equipment must have access.

A view upstream of the sedimentation system showing the drainage line from the pens to the sedimentation system. The drains run under an on-site roadway, through a concrete culvert that permits the uninterrupted flow of effluent to the sedimentation system.

Step 2

Choose the most appropriate type of sediment removal system (basin, terrace or pond) depending on local climate and location characteristics.

Step 3

Assess the need for more than one sediment removal system. Wet manure is difficult to handle and there are problems with its subsequent storage and use. In higher rainfall areas, two sedimentation basins in parallel may be preferable so that one can be drying out prior to cleaning whilst the other one is in use.

Step 4

Determine the length/width (L/W) ratio for the configuration to maximise the flow path within the sediment removal system so as to maximise sediment deposition (see Figure 4). The location of inflow points in relation to the outlet control weir is important to maximise settling. Sediment dewatering may need to drain back into the basin, thus affecting the footprint area required for a sedimentation basin.

Propose a footprint for the sediment removal system, taking into account the optimal configurations from Figure 4.

Step 5

Having proposed a configuration to maximise settling, calculate the length to width ratio to determine the settling volume.

Step 6

Determine the area and characteristics of the controlled drainage area catchment flowing into the sediment removal system. The controlled drainage area is discussed in *Section 10 – Pen and drainage systems.*

Step 7

Calculate the peak inflow rate for a 20-year ARI storm. A procedure for calculating the design inflow rate for a given ARI storm is provided in *Section 10 – Pen and drainage systems.*

Step 8

The sedimentation system should be designed to deposit solids settling at a maximum flow velocity of 0.005 m/s. The volume required to achieve settling at the required velocity is determined by using the following formula:

$$V = Qp.L/W\,.\left(\frac{\lambda}{v}\right).$$

where

V = sedimentation system design volume (m^3)
Q_p = peak inflow rate for a design storm with an average recurrence interval of 20 years
L/W = length to width ratio, where L is the length along the direction of flow
λ = a scaling factor
ν = flow velocity (m/s): maximum = 0.005 m/s

Lambda (λ) is a scaling factor that accounts for sediment accumulation and removal frequency. Values for lambda are set out in Table 1 for each of the three types of sedimentation systems.

Table 1. Scaling factors

Sedimentation system	L/W	λ
Basins	2–3	2.5
Terraces	8–10	1
Ponds	2–3	6

Sediment basin effectively retaining sediment and draining to bed level, allowing deposited solids to dry.

Step 9

Determine the required storage depth from the required cross-sectional area of flow and footprint area. The depth required is usually not equal to the design volume divided by the footprint area as it does not take into account the height and volume occupied by side batters for the storage. This can be significant for a deep storage.

Step 10

Sedimentation systems (other than ponds) should preferably be built with temporary storage depths less than 1.0 m. If the calculated depth exceeds 1.0 m, either the foot print area needs to be increased or if this is not possible, a sedimentation pond option should be considered. The design of a sediment removal system should also provide for adequate storage for settled sediment to prevent the need for frequent sediment removal. This provision needs to be added to the volume calculated in Step 7. Sedimentation systems should be cleaned as required to maintain their designed dead storage capacities and to ensure operational efficiency. However, having to clean more frequently than once a year can pose problems in selecting a time with suitable weather conditions.

Sediment has built up between the walls of this control outlet as there is insufficient space for maintenance equipment to reach it. The control structure should have been located at the end of the block wall structure.

Step 11

Determine the area and characteristics of the controlled drainage area flowing out of the basin (i.e. area from Step 5 plus the surface area of the basin).

If a large, shallow sedimentation basin is being designed, the controlled drainage area at the outlet may be considerably larger than the controlled drainage area at the inlet. Heavy rainfall falling onto the basin itself contributes to the outlet flow.

Step 12

Using the area in Step 10, determine the peak outflow rate for a 50-year ARI storm. The calculation of the peak flow rate is discussed in *Section 10 – Pen and drainage systems.*

Step 13

Using a freeboard of 0.9 m, determine the required width of an outlet weir capable of carrying the outflow resulting from a design storm. For a sedimentation pond this is the width of the outlet structure.

The required width of the weir can be calculated using the broad crested weir formula below and the peak flow from Step 12.

$$b = \frac{Q}{C_d \times h^{3/2}}$$

where

b = width of outlet weir (m)
h = depth of water above the crest of the outlet weir (m)
Q = peak flow rate (m^3/s)
C_d = weir coefficient (1.66)

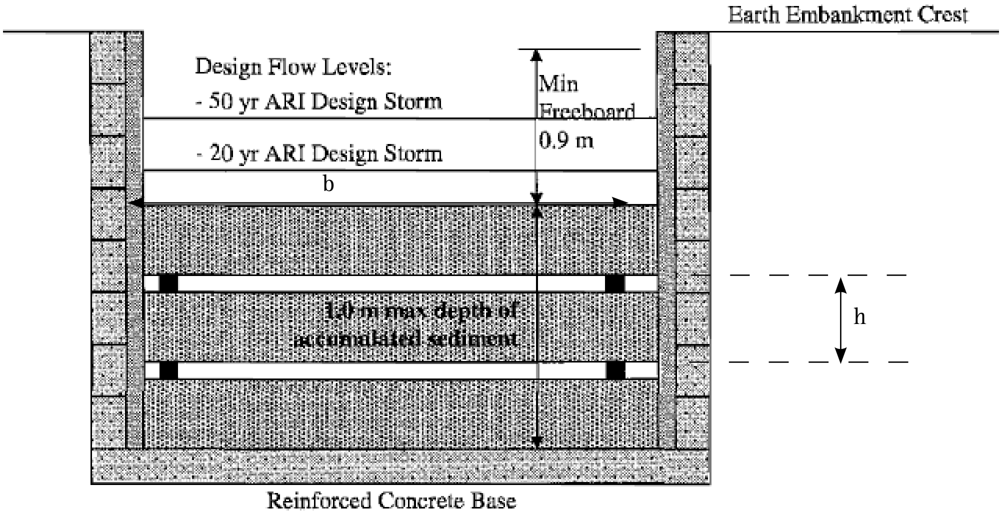


Figure 5. Details of outlet weir dimensions (Skerman, 2000)

A minimum width of 2.5 m is recommended to allow access by cleaning machinery. Ensure that effluent stored in the holding pond does not back up into the sedimentation system. The top water level of the holding pond (bywash level) should be at least 0.3 m lower than the bed of the outlet weir.

Cleaning, maintenance and de-silting

Maintenance of the sedimentation system is always central to its operation. Sedimentation systems treat runoff by slowing flow velocities and promoting coarse to medium-sized sediments to settle. Maintenance involves ensuring that the outlet is not blocked with debris and that sediment deposition is not substantially reducing the active volume of the sedimentation system, which results in excessive odour emission and poor settling performance.

Accessibility for maintenance is an important part of design. Figure 6 illustrates critical dimensions for an excavator. If an excavator is able to reach all parts of the basin from the top of the bank/batter/berm, an access ramp may not be required; however, the need for an access track around the perimeter of the basin will affect the overall earthworks design.

If sediment collection requires earthmoving equipment to enter the basin, a stable ramp having a gradient not greater than 1 vertical: 10 horizontal will be needed to access the base of the sedimentation basin. In this case, sedimentation basins should be constructed with a hard (i.e. rock/gravel) base, with a bearing capacity sufficient to support maintenance machinery when access is required within the basin.

Apart from protecting the impermeable base of the structure, this feature assists excavator operators in detecting when they have reached the base of the basin during de-silting operations.

Upstream of the outlet control structure. Excessive removal of sediment has caused the floor of the basin to be lower than that of the control structure so the basin cannot fully drain. When removing sediment, do not alter the base of the sedimentation structure.

Sedimentation basins and terraces should be capable of draining by gravity down to the base level.

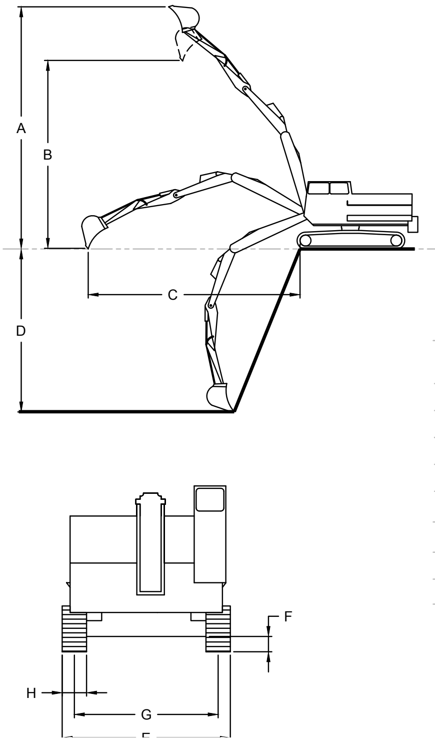
Inspections of the inlet configuration following storms should be made soon after construction to check for erosion. In addition, regular checks for sediment buildup will be required as sediment loads from developing new catchments vary significantly.

The National Guidelines for Beef Cattle Feedlots state that sedimentation terraces and basins should be cleaned as soon as practicable after significant material builds up. A desirable frequency of basin de-silting is generally triggered when sediment accumulates to half the basin depth. Debris and sediment should be inspected regularly and debris removed before it blocks inlets or outlets.

Pen (box) scrapers are ideal for removing sediment from dry sediment basins because they can accurately maintain bed gradients that promote good drainage. Other suitable machinery includes graders and front end loaders.

A compacted gravel base in the basin will allow cleaning machinery to operate under wet conditions and will protect the impermeable layer. If the individual cells of a basin, terrace or pond are constructed no wider than about 20 m, sediment can be removed efficiently using an excavator working from the banks. For larger systems, a tracked excavator may be suitable for working within the system as long as conditions are relatively dry.

The excavator must have suitable reach and digging depth.



CRITICAL MEASUREMENTS

A. MAX. CUTTING HEIGHT
B. MAX. LOADING HEIGHT
C. MAX. REACH ALONG GROUND
D. MAX. DIGGING DEPTH
E. WIDTH TO OUTSIDE OF TRACKS/TYRES
F. GROUND CLEARANCE
G. TRACK/TYRE CENTRELINE
H. GROUSER PLATE/TYRE WIDTH

Figure 6. Critical dimensions of excavator for cleaning

Operational maintenance

Operational maintenance is the level required to minimise the risk of major structural component and/or flow control failure, and to ensure that the facility continues to function as designed. Neglecting maintenance could cause sediment to build up, resulting in odour nuisance or embankment failure and subsequent property damage. Neglected maintenance often causes a facility to cease functioning as per the original design, with flow rates exceeding 0.005 m/s.

A program of scheduled periodic inspection of the sedimentation system is essential for early recognition of the need for potential maintenance. The following actions should be performed periodically and preventive or corrective measures undertaken as required

- Routine inspection of the sediment removal system to identify depth of sedimentation accumulation, damage to the batters, scouring or sediment build up (after first three significant storms and then at least every three months).
- Routine inspection of inlet and outlet points to identify any areas of scour, sediment build up and blockages.
- Removal of sediment during dry periods after a rain event, or as required.

The date and nature of the inspection, maintenance and cleaning performed should be recorded to assist ongoing management and to demonstrate responsible operating practices.

After a heavy storm, any possible erosion and any other damage should be checked.

Volume maintenance

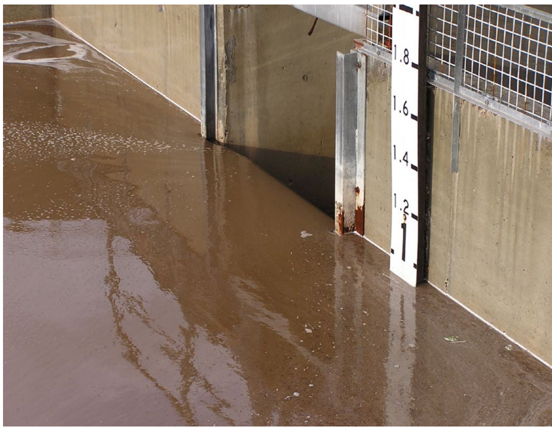
One of the most important variables in the design of a sedimentation facility is the volume available for the storage of sediment. If a sedimentation system is allowed to accumulate sediment and debris, this will decrease the storage volume and the ability of the system to function as designed can be greatly reduced. Therefore, it is essential to maintain the design volume by cleaning. In the case of a sedimentation basin it is recommended that that some depth marker be installed in the basin to indicate the maximum level for silt buildup.

Avoiding contamination of groundwater

If a geotechnical assessment of the site suggests a high risk of contamination of underground water resources because of leaching of contaminants, the administering authority may require the installation of a clay or synthetic lining in the bed and batters of the sedimentation system. Clay lining is considered in *Section 12 – Holding pond design*.

Maintenance of the base of the sedimentation system with a box scraper. Dual sedimentation structures before the holding pond will allow one to be de-silted while runoff is diverted to the other.

Cleaning out a sedimentation basin in relatively wet conditions is not desirable as wet sludge is difficult to handle, store and will not dry out.



Marker indicating sediment buildup. The level of buildup can be seen when water is released through the drop weir.

Solids have been effectively controlled. Now the system needs cleaning immediately.

Where possible, solids and larger suspended matter should be removed from the effluent stream from hospital pens, cattle washing facilities and induction facilities with a coarse screen before the settling pond. The base of this area should be large enough to allow maintenance equipment to remove the settled sediments.

'Small catchment' sedimentation basins

The local catchment area of cattle handling, cattle wash and/or vehicle washdown facilities can have a separate sediment basin to capture and retain sediment. Most runoff into these sediment basins is from cleaning water, rather than rainfall.

These sediment basins may be non-trafficable or trafficable.

The non-trafficable types are typically in ground tanks, conventional 'box' shaped concrete pits or longitudinal drains with grates.

Trafficable types allow the material collected in the pit to be cleaned out with the cleaning machinery entering the basin.

The sedimentation basin should be located to the side of the washdown area and not covered by a grate, to allow easy access for machinery to remove sludge.

The sediment basin should drain completely to bed level so that the basin can dry out and be cleaned to prevent potential odour. Often, dual basins allow the first basin to dry out and be cleaned when inflow is diverted to the second basin.

The factors to be considered when designing trafficable sedimentation basins include

- volume of wastewater generated and the required wastewater storage volume
- materials for construction
- vehicular access
- drainage
- cleaning frequency
- depth and slopes, relative to other components of the wastewater management system
- physical management of the sludge and solid waste disposal
- equipment available for cleaning
- pumping, or gravity release of wastewater
- configuration of weeping wall/bar screen

Designs need to take into account the specifications of the vehicles needed to clean the sediment basin, with the ramp large enough for easy access and manoeuvrability when cleaning. The recommended grade of access ramps is 1 in 10 even for 4WD tractors.

The width of the sediment basin is set by the width of the cleaning vehicle and loader bucket. Table 2 provides typical bucket widths of machinery commonly used at feedlots. For large vehicles, allow at least 100–300 mm either side of the bucket for sideways movement during cleaning.

Table 2. Typical bucket widths of various equipment

Equipment	Bucket width (mm)	Allowance (mm)	Total width (mm)
Skidsteer loader			
35 kw (47 hp)	986 (39“)	150	1136
53 kw (71 hp)	1134 (45”)	150	1284
70 kw (95 hp)	1386 (55”)	300	1686
Tractor front end loader			
37–60 kw (50–80 hp)	1500–1800 (59-70”)	300	1800–2100
52–75 kw (70–100 hp)	1800–2100 (70–83”)	300	2100–2400
76–112 kw (100–150 hp)	2100–2400 (83–95”)	300	2400–2700
112–150 kw (150–200 hp)	2100–2400 (83–95”)	300	2400–2700
Backhoe loader			
65 kw (88 hp)	2262 (89”)	300	2562
75 kw (98 hp)	2350 (92”)	300	2650

Sediment basins should also have some type of grooving on concrete entry ramps to provide better traction, as they have a tendency to become slippery.

A double-sided trafficable solids basin at a truck wash facility

Effluent can be diverted into one side of the basin so that the other side can dry out and sediment be removed.

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